

YIELD ASSESSMENT OF ELEPHANT FOOT YAM GROWN UNDER MULTILAYER VEGETABLE CROPPING SYSTEM

RAJ PAL SINGH*, S. BHUSHAN, SANTOSH KUMAR AND RAVI SHANKER

GVT – Krishi Vigyan Kendra, Godda - 814 133, Jharkhand, INDIA

e-mail: aaidu69@gmail.com

KEYWORDS

Intercropping
Elephant foot yam
Cucurbits, Vegetables

Received on :

03.05.2013

Accepted on :

17.09.2013

*Corresponding
author

ABSTRACT

Field experiments were conducted during the year 2010-11 and 2011-12 to assess the yield and yield attributing characters of elephant foot yam sown with bottle gourd, ridge gourd and bitter gourd under multilayer vegetable cropping system. The days taken to 50 per cent crop (elephant foot yam) emergence (51 days), girth of pseudostem (21 cm), canopy spread (82.4 cm) and yield of corms (376.07 q/ha) was observed highest in the sole crop of elephant foot yam followed by elephant foot yam + bitter gourd with non significant difference and additional yield of bitter gourd (138.8 q/ha). The results clearly indicated that the vegetable bitter gourd can be profitably intercropped with the elephant foot yam.

INTRODUCTION

Elephant foot yam (*Amorphophallus paeoniifolius*) is an important crop cultivated for its edible corms. It can be rise profitably as an intercrop in different horticultural crops. They can supplement the food requirement of the family besides providing additional employment (Jata *et al.*, 2009). It is rich in calcium, phosphorus and other minerals and vitamins. To increase the production of both vegetables and tuber crops from same piece of land without hampering the main crop yield, the most efficient practice would be to grow these crops in intercropping system. Elephant foot yam being a long duration, widely spaced crop, takes about 50 - 60 days or more to spread into a full ground cover. Therefore, enough sunlight and space are available in the early growth stage of this crop. Moreover, the crop removes appreciable quantities of nutrients from the soil. Large amount of organic matter is required to maintain the soil health and quality. Short duration vegetables when grown and turned under can build up the soil organic matter and nitrogen in the soil (Chattopadhyay *et al.*, 2008). Sen *et al.* (1993), Kannan *et al.* (2001) and Chattopadhyay *et al.* (2008) conducted the experiments and found that short duration vegetables can be profitably intercropped with elephant foot yam. The farmers of our region grow low yielding local variety of elephant foot yam in the backyard space of their houses in scattered way as a sole crop. But if it is cultivated in scientific way, there is a great possibility for utilizing the interspaces of elephant foot yam during early growth stage by growing short duration cucurbitaceous vegetable crops like bitter gourd, ridge gourd, bottle gourd, etc., thereby increasing the return per unit area land. The present experiment was thus undertaken to find out the suitability of cucurbits as an intercrop with elephant foot yam to get additional income without affecting the main crop

yield in the Godda district of Jharkhand state.

MATERIALS AND METHODS

The field experiments were carried out during the year 2010-11 and 2011-12 in five villages viz. Nipania, Sundermore, Belbathan (Godda block), Mohanpur (Sunderpahadi block) and Boha (Poraiyahaat block) of Godda district by Gramin Vikas Trust – Krishi Vigyan Kendra, Godda (Jharkhand) under National Agricultural Innovation Project to assess the yield and yield attributing characters of elephant foot yam with cucurbits bottle gourd (*Lagenaria siceraria*), ridge gourd (*Luffa acutangula*) and bitter gourd (*Momordica charantia*) under multilayer vegetable cropping system. The soil of the experimental site was sandy loam in texture having medium fertility status with neutral pH. The average annual rainfall varies from 1000-1300 mm with majority of rainfall occurring during the monsoon season (July to September). The average maximum and minimum temperature varies from 12°C to 41°C (Table 1). The experiment was laid out in RBD with following four treatments and ten replications:

1. Sole crop of elephant foot yam (CV. Gajendra)
2. Elephant foot yam + Bitter gourd (CV Hybrid US6214)
3. Elephant foot yam + Ridge gourd (CV local)
4. Elephant foot yam + Bottle gourd (CV Hybrid Mahima)

Elephant foot yam (EFY) variety Gajendra was planted during the second fortnight of June at 75cm x 75cm spacing in the plot size of 1000m². A pit size of 30 cm x 30 cm x 30 cm was dug out and 2 kg well decomposed cow manure was filled 3/4th of pit. 500 g cut tubers of elephant foot yam were treated with cow dung slurry (one kg of fresh cow dug in one litre of water) one day before planting on the pit and then filled the pit

with the remaining soil and small mound was formed on the pit. The seeds (hybrid) of cucurbits bitter gourd, ridge gourd, and bottle gourd were sown in between two rows of main crop i.e. elephant foot yam at the recommended spacing for each crop.

All the plots were fertilized with 150 Kg N, 100 Kg P₂O₅ and 150 Kg K₂O/ hectare. Half dose of nitrogen and potash and full dose of phosphorus were applied at the time of planting of main crop in pits and rest half of nitrogen and potash were applied after harvesting the companion crops i.e. at 95 days after planting (DAP). Recommended dose of fertilizer was also given to the companion crops i.e. bottle gourd, ridge gourd and bitter gourd as per schedule. All other cultural practices as per schedule for the cultivation of main crop as well as companion crops were followed to raise healthy crop. A *machan* like structure was erected with the help of bamboo, wire and threads over 6.5 feet height from the ground level over the main crop i.e. EFY to spread the vines of bottle gourd, ridge gourd and bitter gourd. That is why it is called multilayer vegetable cropping system.

Picking of bottle gourd, ridge gourd and bitter gourd were done at an appropriate interval i.e. 4-7 days after attaining the marketable size, which continued up to 95 days after sowing. Bitter gourd was harvested 9 times and ridge gourd and bottle gourd was harvested 8 times. Harvesting of main crop (EFY) was done at 210 DAP. Observations on days to 50% emergence, height of pseudostem, basal girth of pseudostem, canopy spread of pseudostem and corm yield of elephant foot yam was recorded in each treatment. The yield of companion crops was also calculated separately. The data were statistically analysed by following the method of Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth attributes of main crop

Days to 50% emergence

The longest period (51 days) of attainment of 50% emergence of shoot was observed when EFY was grown as sole crop (Table 2). The difference in sprouting time due to growing of different companion crops was significant. The minimum period (44 days) of 50% emergence of main crop was accounted when elephant foot yam was grown with bottle gourd followed by ridge gourd (46 days). This may be due to the some competition for growth resources for earlier physiological processes. Apart from this, the initial upper

Table 1: Weather parameters during the crop growth period (mean of 2010-11 and 2011-12)

Month	Temperature (°C)		Rain fall (mm)
	Max	Min	
April	40.38	14.83	18.6
May	37.58	13.61	64.8
June	37.21	14.15	186.9
July	35.2	14	251.5
August	35.09	22	253.8
September	35.08	25.02	189.8
October	33.82	24.8	73.2
November	31.82	24.5	8.9
December	29.93	20.85	2.6
January	20.42	12.77	12
February	26.37	12.98	18.9
March	32.42	14.8	14.5

coverage by the leaves of bottle gourd and ridge gourd due to the spread of vines on the structure made by bamboo and wire below which elephant foot yam was grown has produced some shading effect, which in turn enhanced the sprouting time of the main crop.

Height of pseudostem

The height of pseudostem was significantly influenced by different combination of multilayer vegetable cropping system (Table 2). The maximum height (55.40 cm) of pseudostem was observed in elephant foot yam when grown with bottle gourd followed by that grown with ridge gourd (55.18 cm), bitter gourd (51.20 cm) and sole crop of elephant foot yam (48.00 cm). The luxuriant vegetative growth and spread the vines of bottle gourd and ridge gourd on the structure over the elephant foot yam might have helped in increasing the height to trap the sunlight for photosynthesis. Plant height reduction in elephant foot yam when intercropped with cucumber has also been reported by Chattopadhyay *et al.* (2008).

Girth of pseudostem

A significant difference with respect to pseudostem girth of main crop was observed due to different multilayer vegetable cropping system (Table 2). The highest girth (21.00 cm) of elephant foot yam was observed in the sole crop followed by growing of elephant foot yam with bitter gourd (20.81 cm), ridge gourd (17.15 cm) and bottle gourd (16.80 cm). However, the girth of pseudostem of elephant foot yam observed in the plots of elephant foot yam grown with bitter gourd and sole crop of elephant foot yam did not differ significantly. Similar result has also been observed by Chattopadhyay *et al.* (2008).



Sole crop of elephant foot yam



Elephant foot yam + bitter gourd



Elephant foot yam + ridge gourd



Elephant foot yam + bottle gourd

Figure 1: Multilayer vegetable cropping system

Table 2: Growth parameters of elephant foot yam (pooled mean) as influenced by different cucurbitaceous crop (2010-11 and 2011-12)

Treatments	Days to 50% crop emergence	Height of pseudostem (cm) 90 DAP	Girth of pseudostem (cm) 90 DAP	Canopy spread (cm) 90 DAP
Sole EFY	51.00	48.00	21.00	82.40
EFY + Bitter gourd	49.00	51.20	20.81	81.80
EFY + Ridge gourd	46.00	55.18	17.15	78.15
EFY + Bottle gourd	44.00	55.40	16.30	76.40
CD at 5%	1.79	2.46	0.75	1.20

DAP - Days after planting, EFY - Elephant foot yam

Table 3: Yield of elephant foot yam and companion crops under multilayer vegetable cropping system

Treatments	Yield (q/ha)			Companion crop			EFY yield equivalent
	Main Crop 2010-11	2011-12	Mean	2010-11	2011-12	Mean	
Sole elephant foot yam (CV. Gajendra)	373.55	378.60	376.07	-	-	-	-
Elephant foot yam + Bitter gourd (CV Hybrid US6214)	372.00	376.50	374.25	138.80	137.50	138.15	91.66
Elephant foot yam + Ridge gourd (CV local)	362.00	362.65	362.32	147.30	147.97	147.64	59.26
Elephant foot yam + Bottle gourd (CV Hybrid Mahima)	327.40	333.10	330.25	251.60	247.90	249.75	50.50
CD at 5 %	8.39	5.50	6.94	8.47	9.27	4.25	-

Considering market price (per kg) of bitter gourd = Rs. 10, ridge gourd = Rs. 6, bottle gourd Rs. 3, Elephant foot yam = 15 and man days = Rs.150

Canopy spread

There was a significant difference in canopy spread (the radial expansion of leaf) among the various crops grown under multilayer vegetable cropping system (Table 2). The highest spread (82.40 cm) was recorded in sole crop of elephant foot yam but it was at par with the canopy spread of elephant foot yam grown with bitter gourd (81.80 cm). However the lowest spread (76.40 cm) was obtained when elephant foot yam was cultivated with bottle gourd. The spread of bottle gourd vines have covered the structure completely and minimum sunlight was allowed to pass, this might have obstructed the horizontal extension of canopy.

Yield of main crop

The corm yield of elephant foot yam was found to be maximum (376.07 q/ha) when grown as sole crop followed by with bitter gourd (374.25 q /ha) (Table -3). However, the difference between the yield of these two were found to be non significant. Apart from the yield of main crop i.e. elephant foot yam, 138.8 q of bitter gourd was also harvested from the same plot of one hectare area. Less competition for resources and better scope of intercultural operations at early growth stages were the favourable points, which might have triggered the process of partitioning photosynthates from source to sink resulting in higher yield of main crop. Das and Maharana (1995) reported that elephant foot yam does not compete for light as because this crop is able to tolerant shade. It was also observed that the inclusion of any of the companion crops reduced the yield of main crop. However the superiority of cowpea and cassava as an intercrops with elephant foot yam was reported by some previous workers (Kannan *et al.*, 2001 and Chattopadhyay *et al.*, 2008). This could be attributed to enhanced addition of nitrogen and organic matter to the soil after decomposition of green matter of bitter gourd. Ravindran *et al.* (2006) also advocated the intercropping of tuber crops for better remuneration.

From the above study it is inferred that the corm yield of elephant foot yam was found maximum when grown as sole crop followed by with bitter gourd under multilayer vegetable cropping system. The results clearly indicated that the bitter gourd can be profitably grown with elephant foot yam under multilayer vegetable cropping system.

ACKNOWLEDGEMENTS

The authors are grateful to the Gramin Vikas Trust (promoted by KRIBHCO) and National Agricultural Innovation Project, ICAR, New Delhi for providing the necessary facilities to conduct the experiment.

REFERENCES

- Chattopadhyay, Arup, Mukhopadhyay, S. K. and Nath Rajib. 2008.** Short duration vegetables as intercrops in elephant foot yam in the Gangetic alluvium of West Bengal: Analysis of growth, yield and economics. *J. Root Crops.* **34(1):** 10-14.
- Das, A. K. and Maharana, T. 1995.** Effect of spacing and intercropping on bunch characters of banana cv. Robusta. *The Orissa Journal of Horticulture.* **23(1-2):** 13-17.
- Jata, S. K., Sahoo, B. and Nedunchezhiyan, M. 2009 (October).** Intercropping elephant foot yam in orchard crops. *Orissa Review.* pp. 82-84.
- Kannan M., Jansirani, P., Sathiyamurthy, V. A., Veeraragavathatham, D. and Sankar, V. 2001.** Standardization of vegetable intercropping system in *Amorphophallus* yam. Changing scenario in the production system of horticultural crop. *South Indian Horticulture.* **49:** 370-372.
- Panse, V. G. and Sukhatme, P. V. 1967.** Statistical Methods for Agricultural Workers, ICAR, New Delhi, India.
- Ravindran, C. S., Nair, M. and Nedunchezhiyan, M. 2006.** Intercropping tuber crops is remunerative. *Indian Horticulture.* **51(6):** 25-27.
- Sen, H., Adhikary, D. D. and Das, P. K. 1993.** Economics of intercropping with elephant foot yam. *J. Root crops.* **19(1):** 55-56.

